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(54) Method and apparatus for cutting a web of flexible material into longitudinally extending strips.

(57) Method and apparatus for cutting a continuous web (14) of flexible material into longitudinally extending strips. The method comprises the steps of winding the web of flexible material to build-up a roll (24) and engaging a rotary blade (48) against a peripheral surface of the roll while the roll is being rotated to draw the web of flexible material. The web of flexible material is continuously slitted by the rotary blade and wound on the roll as separate strips.

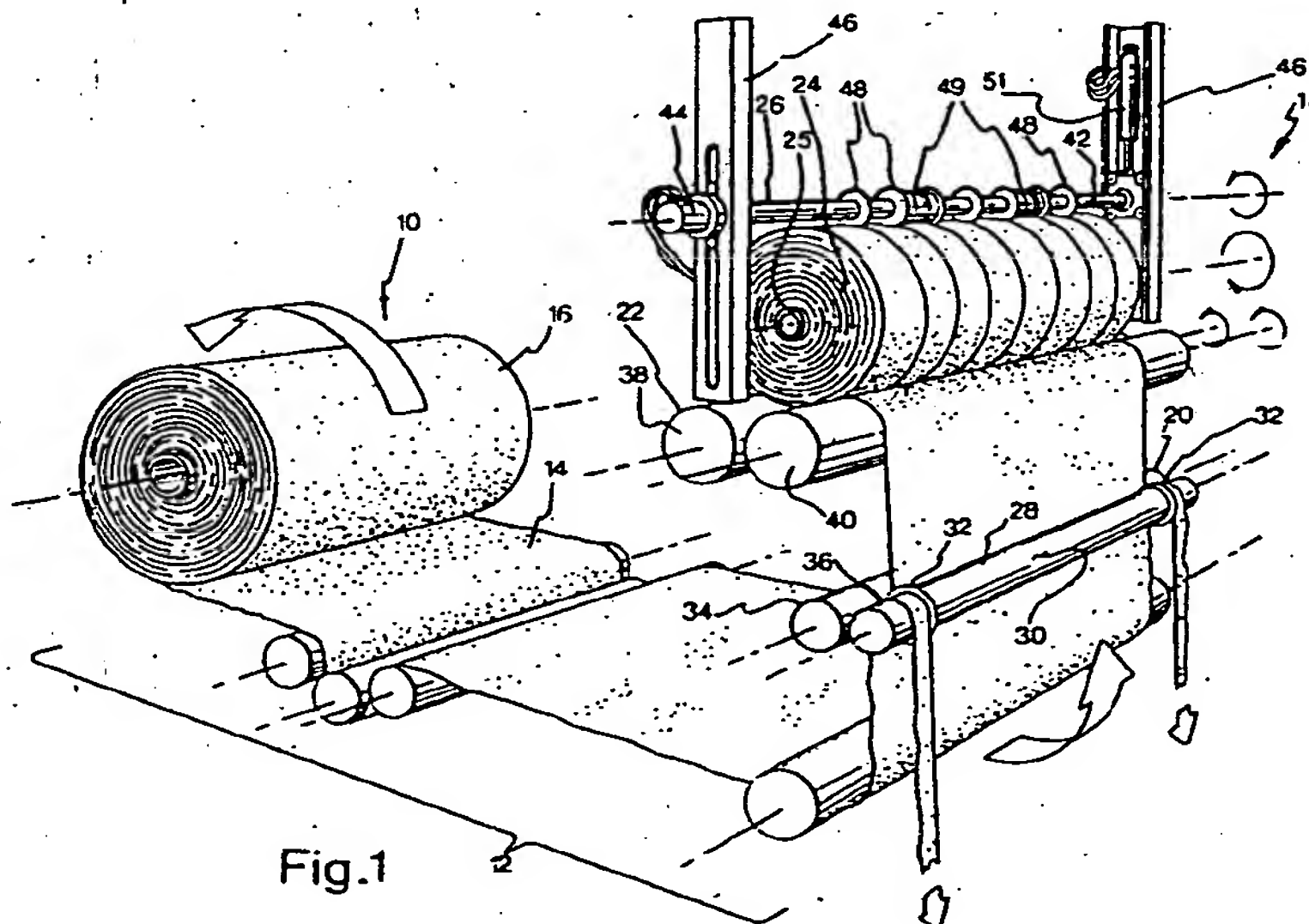


Fig.1

FIELD OF THE INVENTION

The present invention relates to a method and an apparatus for slitting a continuous web of flexible material into narrower, longitudinally extending strips. Advantageously, the invention can be used for slitting a web of fluid absorbent material, such as peat moss into strips that can be directly processed in automatic equipment to assemble disposable absorbent products, such as sanitary napkins, diapers, adult briefs, urinary pads, wound dressings and the like.

BACKGROUND OF THE INVENTION

The prior art has recognized the potential of peat moss material for use as an absorbent medium in structures for absorbing body exudate. Peat moss material has highly desirable fluid absorption properties such as a remarkable absorption capacity and the ability of "drying" adjacent materials by continuing to pull or wick fluid away from them over a long time period such that virtually all the fluid is collected in the peat moss core. These attributes allow the material to provide highly efficient absorbent components which can be made relatively thin for better fit, comfort and discretion, while being sufficiently absorbent to prevent overflow leakage and garment staining.

The following United States Patents document the use of peat moss material for manufacturing absorbent components for disposable absorbent products:

PATENT #	INVENTOR	DATE ISSUED
4,170,515	Lalancette et al.	October 9, 1979
4,215,692	Levesque	August 5, 1980
4,226,237	Levesque	October 7, 1980
4,305,393	Nguyen	December 15, 1981
4,473,440	Ovans	September 25, 1984
4,507,122	Levesque	March 26, 1985
4,618,496	Brasseur	October 21, 1986
4,676,871	Cadieux et al.	June 30, 1987
4,992,324	Dubé	February 12, 1991
5,053,029	Yang	October 1, 1991

The subject matter of these references is incorporated herein by reference.

Peat moss material can be formed in a highly cohesive web by any one of the processes disclosed in the above identified prior art. In a web form, the peat moss material is convenient to handle and it can be directly processed in high speed automatic equipment for assembling disposable absorbent products.

Equipment capable to manufacture disposable absorbent products functions most efficiently when the peat moss web is supplied in narrow continuous strips, whereby no edge trimming is required to form the individual absorbent cores. In practice, the width of an absorbent core is relatively small, in the order of 5 centimetres for a sanitary napkin and somewhat wider for a diaper or a disposable adult brief. To obtain such narrow strips, it is common practise to longitudinally cut a wide web of peat moss material in a plurality of strips that are winded on a common core to form independent rolls having the requisite width. The cutting process is carried out by passing an unsupported run of the peat moss web through a cutting station having a cutting assembly extending transversely with relation of the web and carrying a plurality of blades in a spaced apart relationship. The blades continuously slit the web as the latter is carried forward. This method works well with webs that have a relatively constant calliper, such as paper. However, the calliper of peat moss webs is difficult to maintain within close tolerances and appreciable variations are often encountered. It has been observed that such calliper variations cause an uneven cutting action by the blades. In extreme cases, the uneven cutting action may cause adjacent strips to overlap when they are winded which may result into breakage of the entire peat moss web.

OBJECT AND STATEMENT OF THE INVENTION

An object of the present invention is a method and an apparatus for cutting a continuous web of flexible material such as peat moss for example, into longitudinally extending strips, allowing to cleanly cut webs of uneven calliper without significant risks of causing an overlap between adjacent strips when the web is being winded or web breakage.

SUMMARY OF THE INVENTION

As embodied and broadly described herein, the invention provides a method for cutting a continuous web of flexible material into longitudinally extending strips, the method comprising the steps of:

- 5 - winding a continuous web of flexible material to build-up a roll and rotating the roll in order to draw the web of flexible material thereon;
- engaging a rotary blade against a peripheral surface of the roll while the roll is being rotated; and
- rotating the rotary blade, whereby the rotation of the roll causes a relative movement between the rotary blade and the web of flexible material taken-up by the roll in order to continuously slit the web
- 10 of flexible material which is wound on the roll as separate strips.

This method allows to slit into longitudinally extending strips and wind webs of material having an uneven calliper, such as peat moss webs, without significant risks of causing adjacent strips to overlap or to cause web breakage. This is due to the fact that the cutting action is carried on the roll itself where the web is firmly supported and is less likely to move or twist as in the case of an unsupported run of the web.

15 Accordingly, a precise cutting action is made possible in spite of calliper variations.

As embodied and broadly described herein, the invention provides an apparatus for cutting a continuous web of flexible material into longitudinally extending strips, the apparatus comprising:

- a winding assembly for winding a continuous web of flexible material to form a roll, the winding assembly rotating the roll to draw the web of flexible material and build-up the roll; and
- 20 - a cutting assembly including a rotary blade engaging a peripheral surface of the roll, whereby the rotation of the roll causes a relative movement between the rotary blade and the web of flexible material taken-up by the roll in order to continuously slit the web of flexible material which is wound on the roll as separate strips.

In a preferred embodiment, the cutting assembly includes an elongated shaft carrying a plurality of circular blades axially spaced apart from one another. The elongated shaft is positioned in a parallel relationship with the roll of flexible material and pressed against the roll. To carry out the cutting action the elongated shaft is rotated in a direction opposite the direction of rotation of the roll. The circular blades may be equidistant from one another to form strips of equal width. It may also be envisaged to vary the spacing between the blades to form on the same roll strips of different width.

30 Advantageously, the cutting assembly is provided with one or more idler rollers rotatably mounted on the elongated shaft between adjacent blades and ride on the roll of flexible material. The purpose of the idler rollers is to control the depth of penetration of the blades in the roll.

In a preferred embodiment, the roll of flexible material is rotated by supporting it on a pair of parallel drive rollers slightly spaced apart to form an elongated cavity receiving the roll of flexible material. One of the drive rollers is rotated which causes the roll of flexible material to turn by virtue of friction between the surface of the drive roller and the web of flexible material.

BRIEF DESCRIPTION OF THE DRAWINGS

- 40 - Figure 1 is a perspective schematical view of an apparatus for slitting a continuous web of peat moss material into a plurality of longitudinally extending strips, constructed in accordance with the present invention;
- Figure 2 is a side elevational view of a winding and cutting station of the apparatus shown in Figure 1;
- Figures 3 and 4 are similar views to Figure 2 showing in the winding and the cutting station a progressively growing roll of peat moss material;
- 45 - Figure 5 is an enlarged fragmentary view of the apparatus shown in Figure 1, illustrating a blade of a cutting assembly penetrating the roll of peat moss material; and
- Figure 6 is a front elevational view of the cutting assembly shown in Figure 5.

DESCRIPTION OF A PREFERRED EMBODIMENT

The apparatus in accordance with the invention is particularly useful for cutting a web of fluid absorbent material, such as peat moss which has an uneven calliper into narrow, longitudinally extending strips. However, it should be appreciated that the invention is not limited to a specific material to be cut as the apparatus may process a wide range of flexible webs, such as paper for example.

55 The cutting apparatus, designated comprehensively by the reference numeral 10, comprises an assembly of guide rollers 12 which direct a web of peat moss material 14 from a supply reel 16 to a winding and cutting station 18. The winding and cutting station 18 includes a trimming assembly 20 for



cutting the side edge portions of the web 14 to provide a web with straight side edges and constant width. The winding and cutting station 18 further comprises a winding assembly 22 for winding the web 14 received from the trimming station 20 into a roll 24 having a core 25, and a cutting assembly 26 for slitting the web on the roll 24 into narrow, longitudinally extending strips which are wound as independent narrow rolls on the core 25.

The trimming station 20 comprises a cutting roll 28 including a rotating shaft 30 which extends transversely to the web 14 and on which are formed radially projecting circular blades 32 in an axially spaced apart relationship. The distance between the blades 32 determines the width of the web 14 that is being fed to the winding and cutting station 18. The cutting roll 28 is associated with an anvil roll 34 comprising circumferential grooves 36 (only one being shown in the drawings) for receiving the blades 32.

The cutting roll 28 and the anvil roll 34 are rotated in opposite directions to cut the side edges of the web 14 by shearing action. The supports for these rolls and their drives have not been shown in the drawings for the purpose of simplicity.

The winding assembly 22 is located above the trimming station 20 and it comprises a pair of elongated drive rollers 38 and 40 which are generally parallel to one another and slightly spaced apart to define therebetween an elongated recess in which the roll 24 is seated. The drive rollers 38 and 40 are coupled to a common drive (not shown in the drawings), and turn in the same direction.

The cutting assembly 26 comprises an elongated shaft 42 generally parallel to the longitudinal axis of the roll 24 and rotated by a drive mechanism 44. The shaft 42 is slidably mounted in vertically extending tracks 46 whereby the entire cutter assembly 26 can move radially with respect to the roll 24. The drive mechanism 44 is such as to maintain the driving relationship with the shaft 42 while the latter slides in the tracks 46. Drives with this characteristic are well known to those skilled in the art and a detailed description thereof is not deemed to be necessary.

The cutter assembly 26 further comprises a plurality of radially projecting circular blades 48 rigidly mounted on the shaft 42 in an axially spaced apart relationship. The blades 48 may be equidistant to slit the web 14 into strips of the same width, or the distance between the blades may be varied to form strips of different width. On the shaft 42 are rotatably mounted a pair of idler rollers 49, situated between adjacent blades 48 and which have a diameter less than that of the blades 48. The idler rollers 49 engage in a rolling contact the peripheral surface of the roll 24 and rotate therewith.

A pneumatic piston-cylinder assembly 51 mounted inside one of the tracks 51 is coupled to the shaft 42 to vertically displace the shaft. The piston-cylinder assembly 51 also serves to urge the cutting assembly 26 against the roll 24. The amount of pressure developed between the cutting assembly 26 and the surface of the roll 24 is controlled by regulating the air pressure in the piston-cylinder assembly 51.

The operation of the cutting apparatus 10 is as follows. The web 14 is unwound from the supply reel 16 and the leading edge of the web is threaded through the guide rollers 12, through the trimming station 20 and up to the winding assembly 22. The leading edge of the web 14 is then manually wound a few turns over the core 25 to start the roll 24. The cutting assembly 26 is lowered by extending the piston-cylinder assembly 51 to rest on the roll 24. The air pressure in the piston-cylinder assembly 51 is adjusted to obtain the desired amount of pressure between the cutting assembly 26 and the roll 24. This parameter is not critical for the success of the invention as the apparatus 10 may be operated at a wide range of pressures between the cutting assembly 26 and the roll 24. Preferably, the pneumatic circuit of the piston-cylinder assembly 51 is such as to be capable of maintaining a constant air pressure therein irrespective of the degree of the extension of the piston-cylinder assembly 51. This feature allows to keep the pressure of the cutting assembly 26 against the roll 24 constant at different vertical positions of the cutting assembly.

The winding assembly 22 is actuated to rotate the drive rollers 38 and 40 in the direction shown by the arrows in Figures 2 to 4. The friction existing between the cylindrical surfaces of the drive rollers 38 and 40 and the web 14 will cause the roll 24 to rotate and draw the web 14 to further build-up the roll.

Simultaneously with the actuation of the winding assembly 22, the drive of the trimming station 20 is actuated, whereby the rolls 28 and 34 are rotated to trim the side edge portions of the web 14 passing between them. The resulting trims are discarded or preferably recycled.

The drive unit 44 of the cutting assembly 26 is actuated to rotate the shaft 42 in a direction shown by the arrows in Figures 2 to 4. The direction of rotation of the shaft 42 is the opposite of the direction of rotation of the roll 24. The blades 48, under the effect of rotation continuously cut the web 14 that is being taken-up by the roll 24 into narrow longitudinally extending strips. Those strips are wound as independent rolls on the core 25. As the diameter of the roll grows, the cutter assembly 26 is raised gradually against the force exerted by the piston-cylinder assembly 51. It should be appreciated that the constant air pressure in the pneumatic circuit of the piston-cylinder assembly 51 allows to keep the pressure between the cutting assembly 26 and the roll 24 generally constant for different roll diameters.

The idler rollers 49 riding on the roll 24 control the depth of penetration of the blades 48 in the roll. Figures 5 and 6 best show this feature. The depth of penetration is determined by the radial extent of the blades beyond the idler rollers 49. In the example shown, the blades have a diameter of approximately 15.24 centimetres and the idler rollers have a diameter of approximately 14.92 centimetres. Accordingly, the depth of penetration is of approximately 0.318 centimetres. A typical peat moss web has a calliper of approximately 0.07 centimetres, whereby the blades 48 extend approximately three to four layers deep in the roll 24.

The scope of the present invention is not limited by the description, examples and suggestive uses herein, as modifications can be made without departing from the spirit of the invention. Applications of the product and the methods of the present invention for sanitary and other health-care uses can be accomplished by any sanitary protection, incontinence, medical and absorbent methods and techniques as are presently or prospectively known to those skilled in the art. Thus, it is intended that the present application covers the modifications and variations of this invention provided that they come within the scope of the appended claims and their equivalents.

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### Claims

1. A method for cutting a continuous web of flexible material into longitudinally extending strips, said method comprising the steps of:
  - 20 - winding a continuous web (14) of flexible material to build-up a roll (24) and rotating said roll in order to draw said web of flexible material thereon;
  - engaging a rotary blade (48) against a peripheral surface of said roll (24) while said roll is being rotated; and
  - 25 - rotating said rotary blade (48), whereby the rotation of said roll (24) causes a relative movement between said rotary blade (48) and said web (14) of flexible material taken-up by said roll in order to continuously slit said web (14) of flexible material which is wound on said roll (24) as separate strips.
2. A method as defined in claim 1, comprising the step of rotating said rotary blade (48) and said roll (24) in opposite directions.
3. A method as defined in claim 1, comprising the step of controlling a depth of penetration of said rotary blade (48) in said roll (24).
- 35 4. A method as defined in claim 1, comprising the steps of supporting said roll (24) on a pair of generally parallel cylindrical surfaces (38, 40) and rotating at least one of said surfaces about a longitudinal axis thereof to cause rotation of said roll (24).
- 40 5. A method as defined in claim 1, comprising the step of displacing said rotary blade (48) radially outwardly with respect to a longitudinal axis of said roll (24) as the diameter of said roll progressively increases.
- 45 6. An apparatus as defined in claim 1, wherein a cutting assembly includes:
  - an elongated shaft (42) on which are mounted a plurality of radially projecting blades (48) in an axially spaced apart relationship;
  - a drive for rotating said elongated shaft (42) about a longitudinal axis thereof; and
  - an assembly (51) for urging said elongated shaft (42) against said roll (24) to cause said blades (48) to cut said web (14) of flexible material into a plurality of longitudinally extending strips.
- 50 7. An apparatus as defined in claim 6, further comprising an idler roller (49) rotatably mounted on said elongated shaft (42), said idler roller having a diameter less than that of said blades (48) and being in a rolling contact with said peripheral surface when said roll (24) is rotated in order to control the depth of penetration of said blades (48) in said roll (24).
- 55 8. An apparatus as defined in claim 1, further comprising a trimming station (20) engaging said web (14) of flexible material to cut a longitudinal edge portion thereof before said web of flexible material is being cut into longitudinally extending strips.

9. An apparatus as defined in claim 1, wherein said rotary blade is capable of moving radially outwardly with respect to a longitudinal axis of said roll, whereby said rotary blade moves radially outwardly with respect to said longitudinal axis as the diameter of said roll progressively increases.
- 5 10. An apparatus as defined in claim 9, wherein said rotary blade is slidingly mounted in tracks (51) which allow said rotary blade (48) to move radially with respect to said longitudinal axis.

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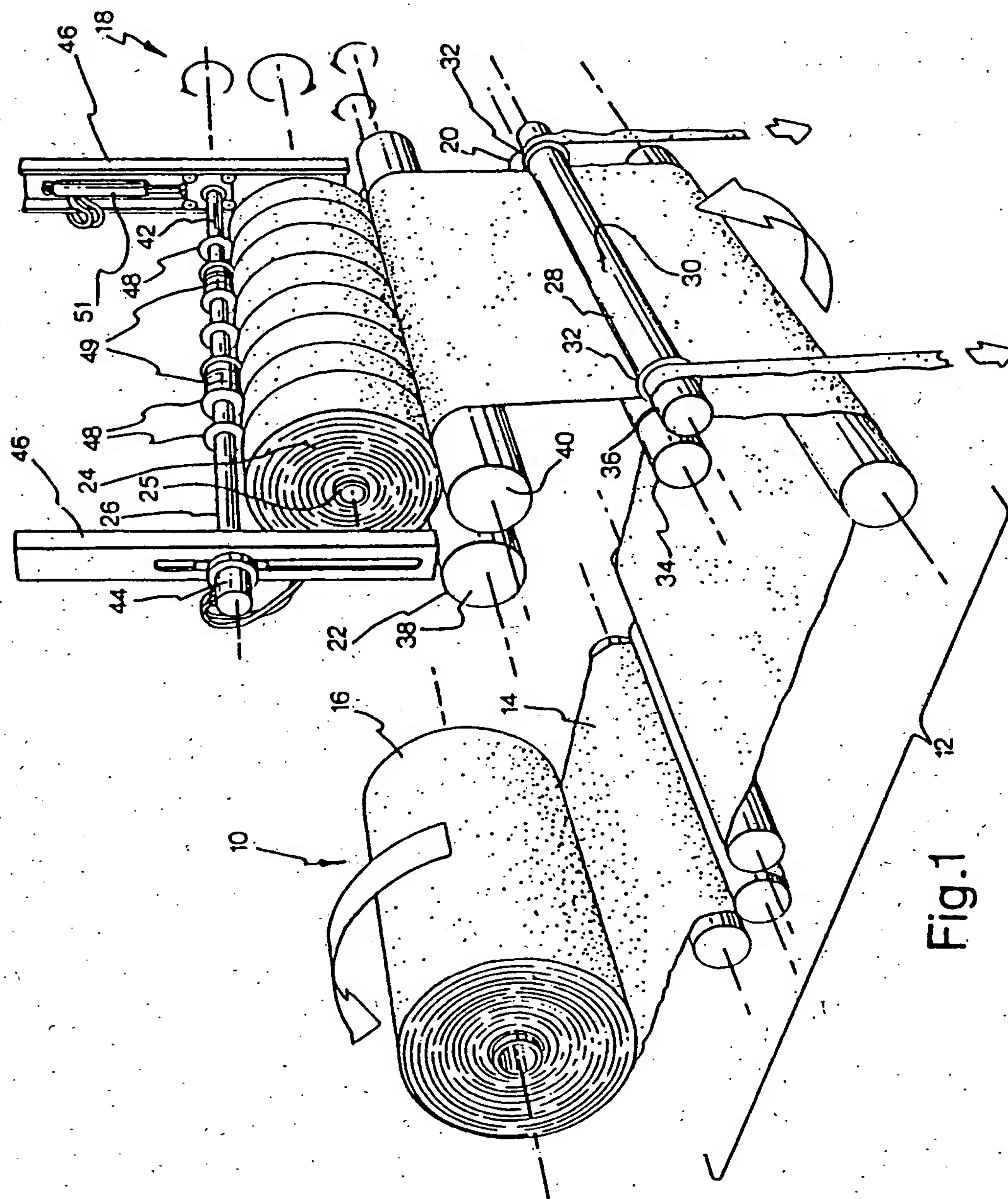
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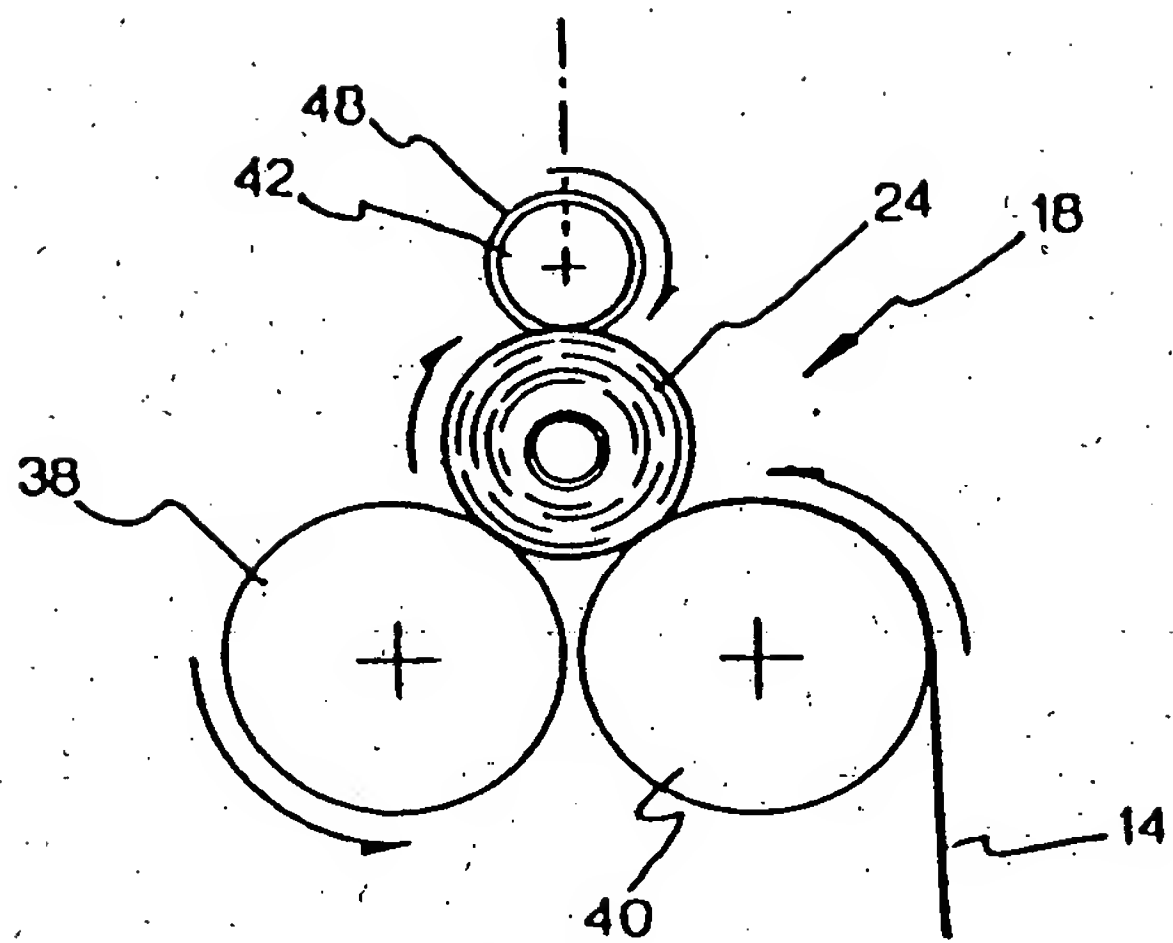


Fig.2

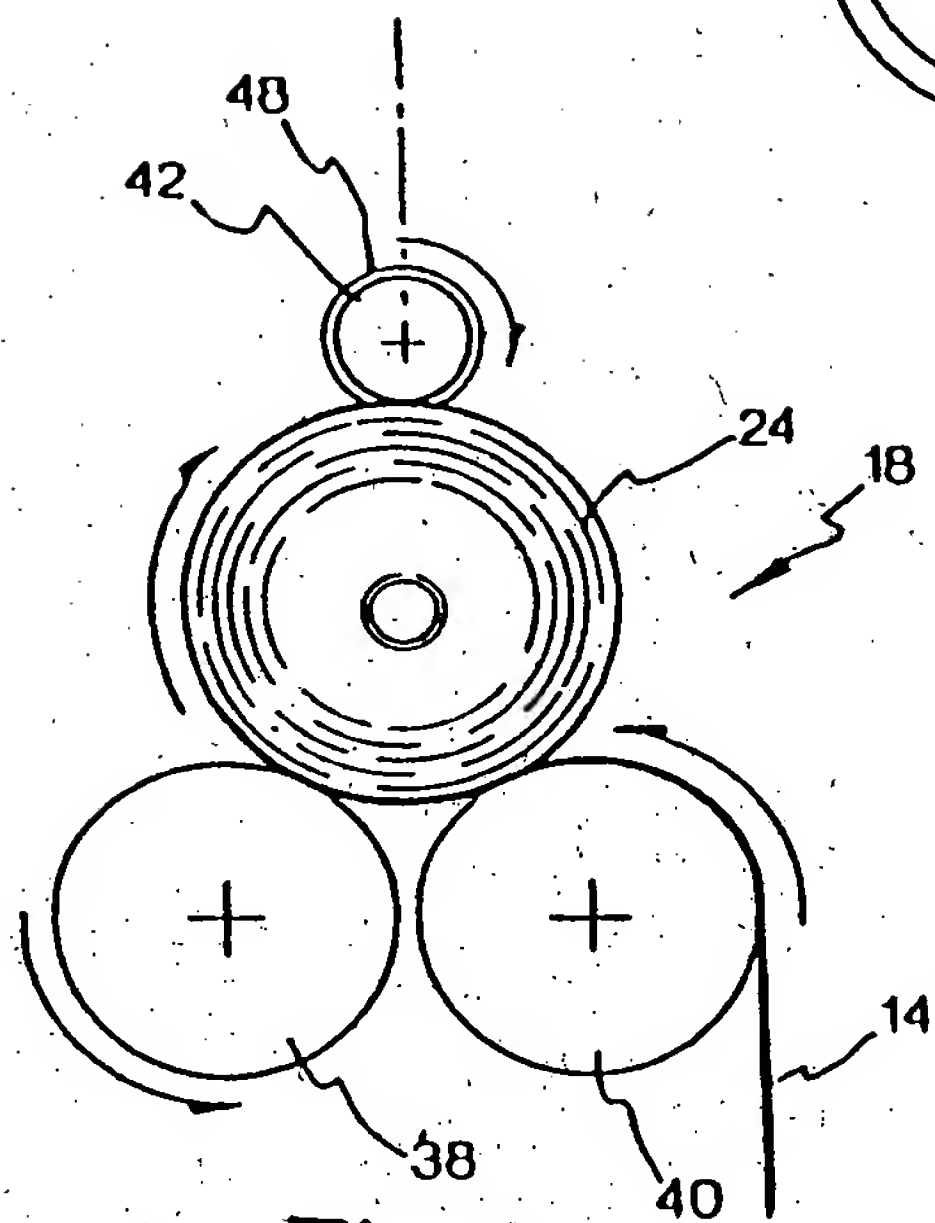


Fig.3

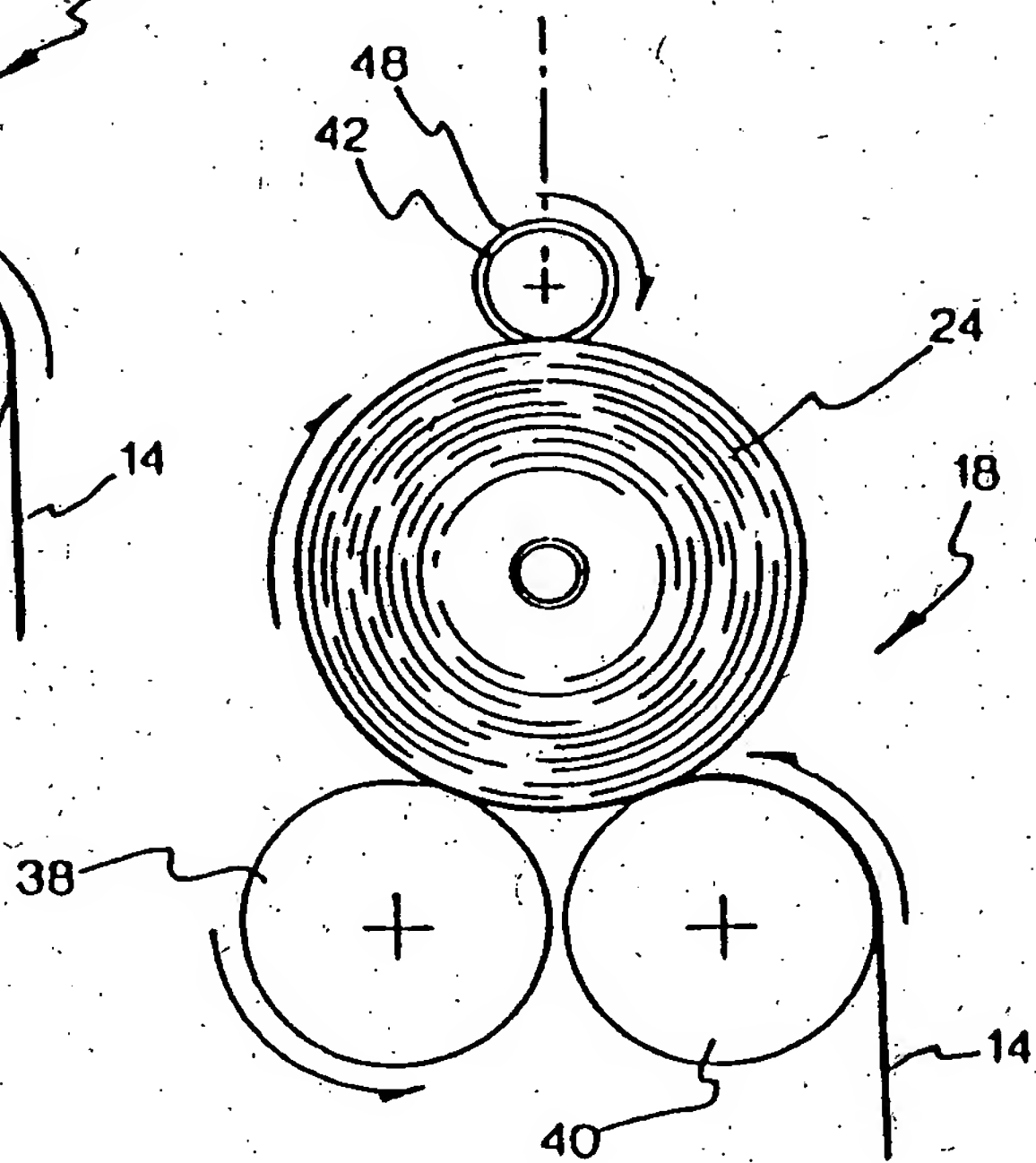


Fig.4



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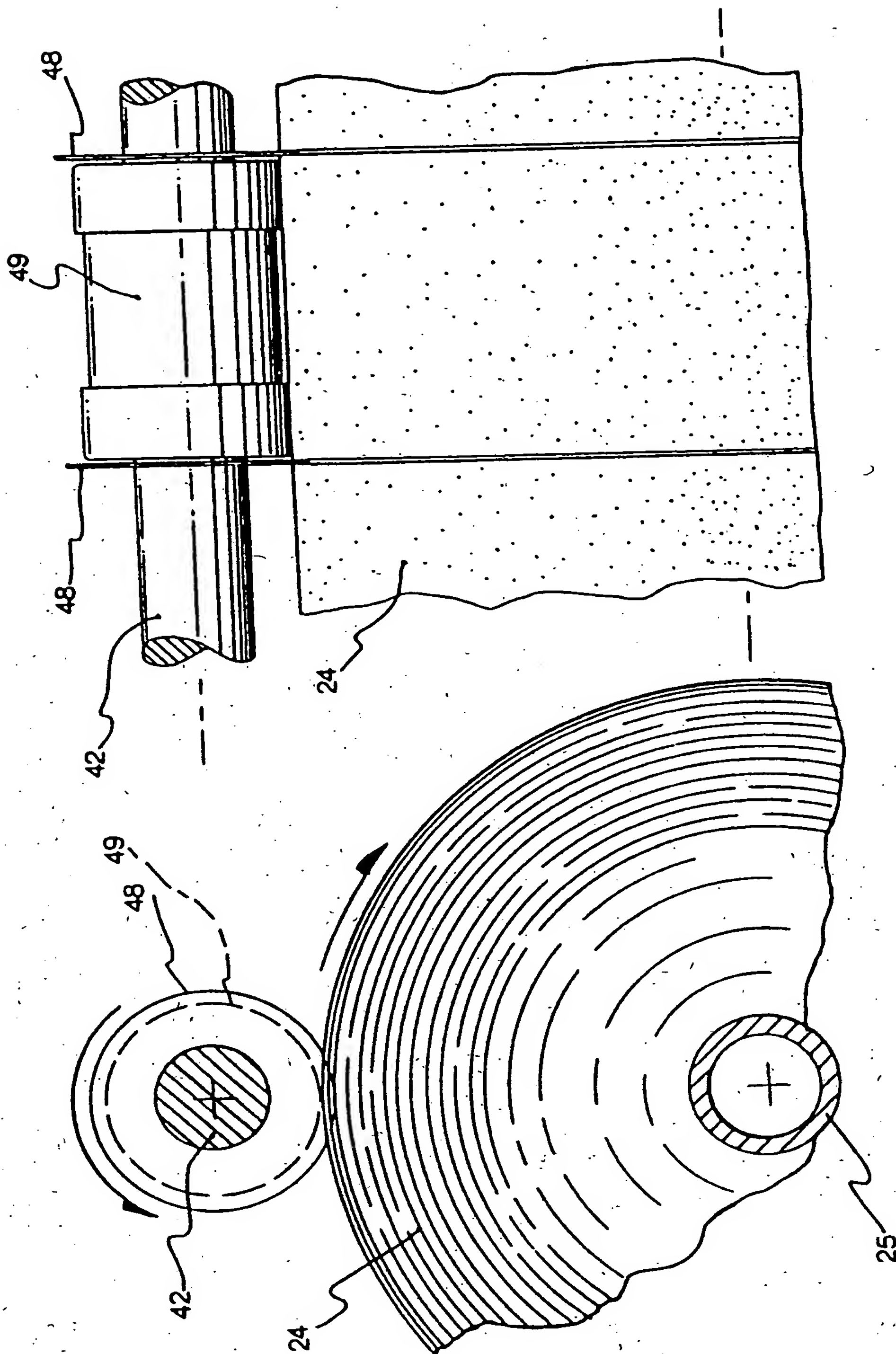


Fig.6

Fig.5



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# EUROPEAN SEARCH REPORT

Application Number

EP 92 12 1266

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	WO-A-8 603 445 (KITAMURA)	1,3-7,9,10	B26D1/157
Y	* abstract; figures *	2,8	
Y	FR-A-2 624 423 (RHONE-POULENC FILMS) * abstract *	2	
Y	DE-A-1 901 999 (MUSCHAL) * page 4, paragraph 4; figures *	8	
A	GB-A-M6793 (JAGENBERG) & GB-A-6793 A.D. 1912		
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B26D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24 MARCH 1993	Examiner VAGLIENTI G.L.M.
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			